GRB 060117: Reverse + forward shock solution

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Summary. — We present a discovery and observation of an extraordinarily bright prompt optical emission of the GRB 060117 obtained by a wide-field camera atop the robotic telescope FRAM of the Pierre Auger Observatory from 2 to 10 minutes after the GRB. We found rapid average temporal flux decay of $\alpha = -1.7 \pm 0.1$ and a peak brightness $R = 10.1$ mag. We interpret the shape of the lightcurve as a transition between reverse and forward shock emission.

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1. – Swift detection

A bright long-soft GRB 060117 was detected by *Swift* satellite on January 17, 2006, at 6:50:01.6 UT. It showed a multi-peak structure with T_{90}=16 ± 1 s with maximum peak flux $48.9 \pm 1.6\,\mathrm{ph\,cm^{-2}s^{-1}}$. Thus, GRB060117 was — in terms of peak flux — the most intense GRB detected so far by Swift Coordinates computed by *Swift* were available within 19 s and immediately distributed by GCN [1].

2. – FRAM and optical transient observation

FRAM is part of the Pierre Auger cosmic-ray observatory [4], and its main purpose is to immediately monitor the atmospheric transmission. FRAM works as an independent,

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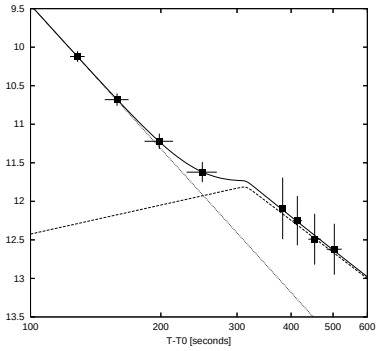

Fig. 1. – The R-band afterglow lightcurve of GRB 060117. The lightcurve is fitted as a superposition of reverse shock (dotted line) and forward shock (dashed line).

RTS2-driven, fully robotic system, and it performs a photometric calibration of the sky on various UV-to-optical wavelengths using a 0.2 m telescope and a photoelectric photomultiplier.

FRAM received the notice at 06:50:20.8 UT, 19.2 s after the trigger and immediately started the slew. The first exposure started at 06:52:05.4, 123.8 s after the GRB. Eight images with different exposures were taken before the observation was terminated. A bright, rapidly decaying object was found, and its presence was reported by [3] soon after the discovery. The FRAM lightcurve for this optical transient is in Figure 1.

3. – Interpretation

Our preffered interpretation (based on the work of [5]) is to fit the data as a transition between the reverse and the forward shock with the passage of the typical frequency break ν_m through the observed passband at time $t_{m,f}$. Corresponding decay indices are $\alpha_{Reverse}$=2.49±0.05 and $\alpha_{Forward}$=1.47±0.03 (see Fig 3).

Other possible interpretations and more details about FRAM telescope, data processing and other follow-up attempts can be found in [2].

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